

Claims

1. A guide wire for use in a re-canalising process for re-canalising a vascular occlusion in a human or animal subject, the guide wire extending between a proximal end and a distal end, and defining a longitudinally extending main central axis, characterised in that the guide wire terminates at its distal end in a terminal member extending axially from the guide wire, the terminal member tapering to a distal leading edge portion for engaging and gradually opening the occlusion as the terminal member is urged therethrough.  
5
2. A guide wire as claimed in Claim 1 characterised in that the leading edge portion is an elongated leading edge portion.  
10
3. A guide wire as claimed in Claim 1 or 2 characterised in that the leading edge portion extends in a direction at an angle relative to an axial direction defined by the main central axis.  
15
4. A guide wire as claimed in any preceding claim characterised in that the leading edge portion extends in a direction at an angle in the range of 1° to 90° relative to an axial direction defined by the main central axis.  
20
5. A guide wire as claimed in Claim 4 characterised in that the leading edge portion extends in a direction at an angle in the range of 30° to 90° relative to an axial direction defined by the main central axis.
- 25 6. A guide wire as claimed in Claim 5 characterised in that the leading edge portion extends in a direction at an angle of approximately 60° relative to an axial direction defined by the main central axis.
- 30 7. A guide wire as claimed in any preceding claim characterised in that the leading edge portion extends in a direction substantially transversely of the main central axis.

8. A guide wire as claimed in any preceding claim characterised in that a first surface portion of the terminal member converges towards an opposite second surface portion thereof towards the leading edge portion.
- 5 9. A guide wire as claimed in Claim 8 characterised in that the first surface portion of the terminal member is planar.
- 10 10. A guide wire as claimed in Claim 8 characterised in that the first surface portion of the terminal member is convex in a longitudinal direction relative to the main central axis.
- 15 11. A guide wire as claimed in Claim 8 characterised in that the first surface portion of the terminal member is concave in a longitudinal direction relative to the main central axis.
12. A guide wire as claimed in Claim 8 characterised in that the first surface portion of the terminal member is sequentially convex and concave in a longitudinal direction relative to the main central axis.
- 20 13. A guide wire as claimed in any of Claims 8 to 12 characterised in that a distal portion of the first surface portion of the terminal member is concave in a longitudinal direction relative to the main central axis.
- 25 14. A guide wire as claimed in any of Claims 8 to 13 characterised in that a proximal portion of the first surface portion of the terminal member is convex in a longitudinal direction relative to the main central axis.
- 30 15. A guide wire as claimed in any of Claims 8 to 14 characterised in that the first surface portion of the terminal member is convex in a transverse direction relative to the main central axis.
16. A guide wire as claimed in any of Claims 8 to 15 characterised in that the

second surface portion of the terminal member converges towards the first surface portion towards the leading edge portion.

17. A guide wire as claimed in any of Claims 8 to 16 characterised in that the  
5 second surface portion of the terminal member is planar.

18. A guide wire as claimed in any of Claims 8 to 16 characterised in that the  
second surface portion of the terminal member is convex in a longitudinal direction  
relative to the main central axis.

10

19. A guide wire as claimed in any of Claims 8 to 16 characterised in that the  
second surface portion of the terminal member is concave in a longitudinal direction  
relative to the main central axis.

15 20. A guide wire as claimed in any of Claims 8 to 16 characterised in that the  
second surface portion of the terminal member is sequentially convex and concave  
in a longitudinal direction relative to the main central axis.

21. A guide wire as claimed in any of Claims 8 to 20 characterised in that a distal  
20 portion of the second surface portion of the terminal member is concave.

22. A guide wire as claimed in any of Claims 8 to 21 characterised in that a  
proximal portion of the second surface portion of the terminal member is convex.

25 23. A guide wire as claimed in any of Claims 8 to 22 characterised in that the  
second surface portion of the terminal member is convex in a transverse direction  
relative to the main central axis.

24. A guide wire as claimed in any of Claims 8 to 23 characterised in that the first  
30 and second surface portions terminate in the leading edge portion to define the  
leading edge portion as a chisel edge.

25. A guide wire as claimed in any of Claims 8 to 24 characterised in that the first and second surface portions of the terminal member define an included angle in the range of 1° to 179°.

5 26. A guide wire as claimed in any of Claims 8 to 25 characterised in that the first and second surface portions of the terminal member define an included angle in the range of 5° to 90°.

10 27. A guide wire as claimed in any of Claims 8 to 26 characterised in that the first and second surface portions of the terminal member define an included angle of approximately 15°.

15 28. A guide wire as claimed in any of Claims 8 to 27 characterised in that the first and second surface portions of the terminal member are joined by spaced apart opposite third and fourth surface portions.

20 29. A guide wire as claimed in Claim 28 characterised in that the leading edge portion of the terminal member extends between the third and fourth surface portions.

30. A guide wire as claimed in Claim 28 or 29 characterised in that the third and fourth surface portions of the terminal member are planar surfaces.

25 31. A guide wire as claimed in Claim 28 or 29 characterised in that the third and fourth surface portions of the terminal member are convex in a transverse direction relative to the main central axis.

30 32. A guide wire as claimed in any of Claims 28 to 31 characterised in that the third and fourth surface portions of the terminal member are parallel to each other in an axial direction defined by the main central axis.

33. A guide wire as claimed in any of Claims 28 to 31 characterised in that the

third and fourth surface portions of the terminal member taper towards the leading edge portion.

5 34. A guide wire as claimed in Claim 32 characterised in that the third and fourth surface portions of the terminal member define an included angle in the range of  $1^\circ$  to  $179^\circ$ .

10 35. A guide wire as claimed in Claim 33 characterised in that the third and fourth surface portions of the terminal member define an included angle in the range of  $5^\circ$  to  $90^\circ$ .

15 36. A guide wire as claimed in Claim 34 characterised in that the third and fourth surface portions of the terminal member define an included angle of approximately  $15^\circ$ .

37. A guide wire as claimed in any of Claims 28 to 36 characterised in that the third surface portion of the terminal member is convex in a longitudinal direction relative to the main central axis.

20 38. A guide wire as claimed in any of Claims 28 to 36 characterised in that the third surface portion of the terminal member is concave in a longitudinal direction relative to the main central axis.

25 39. A guide wire as claimed in any of Claims 28 to 36 characterised in that the third surface portion of the terminal member is sequentially convex and concave in a longitudinal direction relative to the main central axis.

30 40. A guide wire as claimed in any of Claims 28 to 39 characterised in that a distal portion of the third surface portion of the terminal member is concave in a longitudinal direction relative to the main central axis.

41. A guide wire as claimed in any of Claims 28 to 40 characterised in that a

proximal portion of the third surface portion of the terminal member is convex in a longitudinal direction relative to the main central axis.

5 42. A guide wire as claimed in any of Claims 28 to 41 characterised in that the fourth surface portion of the terminal member is convex in a longitudinal direction relative to the main central axis.

10 43. A guide wire as claimed in any of Claims 28 to 41 characterised in that the fourth surface portion of the terminal member is concave in a longitudinal direction relative to the main central axis.

15 44. A guide wire as claimed in any of Claims 28 to 41 characterised in that the fourth surface portion of the terminal member is sequentially convex and concave in a longitudinal direction relative to the main central axis.

45. A guide wire as claimed in any of Claims 28 to 44 characterised in that a distal portion of the fourth surface portion of the terminal member is concave in a longitudinal direction relative to the main central axis.

20 46. A guide wire as claimed in any of Claims 28 to 45 characterised in that a proximal portion of the fourth surface portion of the terminal member is convex in a longitudinal direction relative to the main central axis.

25 47. A guide wire as claimed in any of Claims 8 to 46 characterised in that the leading edge portion is radiused from the first surface portion of the terminal member to the second surface portion thereof.

48. A guide wire as claimed in any preceding claim characterised in that the leading edge portion is radiused in plan view.

30

49. A guide wire as claimed in any preceding claim characterised in that the leading edge portion is convex in plan view.

50. A guide wire as claimed in any of Claims 1 to 48 characterised in that the leading edge portion is concave in plan view.

5 51. A guide wire as claimed in any preceding claim characterised in that the maximum outer transverse cross-sectional area of the terminal member is substantially similar to the outer transverse cross-sectional area of the guide wire adjacent the terminal member.

10 52. A guide wire as claimed in any preceding claim characterised in that the outer transverse cross-sectional area of the terminal member adjacent the guide wire is similar to the outer transverse cross-sectional area of the guide wire adjacent the terminal member so that the outer surface of the terminal member is in axial alignment with the outer surface of the guide wire adjacent the terminal member.

15 53. A guide wire as claimed in any preceding claim characterised in that the guide wire adjacent the terminal member and the terminal member adjacent the guide wire are of circular transverse cross-section, and are of substantially similar outer diameters.

20 54. A guide wire as claimed in any preceding claim characterised in that the transverse width of the leading edge portion does not exceed the transverse width of the guide wire adjacent the terminal member in a plane containing the leading edge portion and extending parallel to the main central axis.

25 55. A guide wire as claimed in any preceding claim characterised in that the guide wire comprises an elongated core wire extending from the proximal end to the distal end.

30 56. A guide wire as claimed in Claim 55 characterised in that the terminal member is secured to the distal end of the core wire.

57. A guide wire as claimed in Claim 55 or 56 characterised in that the core wire terminates in a distal portion of rectangular transverse cross-section defining first and second opposite major surfaces joined by first and second opposite minor surfaces for facilitating bending thereof for offsetting the terminal member relative to the main central axis for facilitating guiding of the terminal member into a branched vessel of a vascular system.

58. A guide wire as claimed in Claim 57 characterised in that the first and second major surfaces of the distal portion of the core wire converge towards each other towards the distal end thereof.

59. A guide wire as claimed in Claim 58 characterised in that the first and second major surfaces of the distal portion of the core wire extend substantially parallel to each other.

60. A guide wire as claimed in Claim 58 or 59 characterised in that the first and second minor surfaces of the distal portion of the core wire diverge from each other towards the distal end thereof.

61. A guide wire as claimed in Claim 58 or 59 characterised in that the first and second minor surfaces of the distal portion of the core wire extend substantially parallel to each other.

62. A guide wire as claimed in any of Claims 57 to 61 characterised in that a reinforcing means is provided on the distal portion of the core wire for minimising axial twisting thereof.

63. A guide wire as claimed in any of Claims 57 to 62 characterised in that the first and second major surfaces of the distal portion of the core wire define therebetween a central major plane extending parallel to the main central axis and cutting the first and second minor surfaces, and the distal portion is curved in the central major plane for offsetting the terminal member relative to the main central



axis for in turn facilitating guiding of the terminal member into a branched vessel of a vascular system.

64. A guide wire as claimed in Claim 63 characterised in that the central major  
5 plane defined by the first and second major surfaces of the distal portion of the core wire extends transversely of a plane containing the leading edge portion of the terminal member and extending parallel to the main central axis.

65. A guide wire as claimed in Claim 63 characterised in that the central major  
10 plane defined by the first and second major surfaces of the distal portion of the core wire extends substantially parallel to a plane containing the leading edge portion of the terminal member and extending parallel to the main central axis.

66. A guide wire as claimed in any of Claims 57 to 65 characterised in that the  
15 core wire extending from the distal portion thereof to the proximal end is of circular transverse cross-section.

67. A guide wire as claimed in any of Claims 55 to 66 characterised in that a  
20 sleeve extends along the core wire from the terminal member and terminates at a location intermediate the distal end and the proximal end of the core wire.

68. A guide wire as claimed in Claim 67 characterised in that the sleeve is of external circular transverse cross-section.

25 69. A guide wire as claimed in Claim 68 characterised in that the external diameter of the sleeve is substantially similar to the diameter of the terminal member adjacent the guide wire.

70. A guide wire as claimed in any of Claims 67 to 69 characterised in that the  
30 sleeve comprises a helical coil located around the core wire adjacent the distal end thereof.

71. A guide wire as claimed in any of Claims 67 to 70 characterised in that a plug extends from the terminal member adjacent a proximal end thereof for engaging an internal bore defined by the sleeve for securing the sleeve to the terminal member.
- 5 72. A guide wire as claimed in any of Claims 67 to 71 characterised in that the terminal member is secured to the sleeve by brazing or soldering.
73. A guide wire as claimed in any of Claims 55 to 72 characterised in that a core wire engaging bore extends into the terminal member for engaging the distal end of  
10 the core wire.
74. A guide wire as claimed in Claim 73 characterised in that the core wire engaging bore extends axially into the terminal member.
- 15 75. A guide wire as claimed in any of Claims 55 to 74 characterised in that the terminal member is secured to the core wire by brazing, or soldering, welding or adhesive.
76. A guide wire as claimed in Claim 75 characterised in that the soldering,  
20 brazing, welding or adhesive material is a radiopaque material.
77. A guide wire as claimed in any preceding claim characterised in that at least a portion of the terminal member is of radiopaque material.
- 25 78. A guide wire as claimed in any preceding claim characterised in that at least a portion of the terminal member is of a magnetic material for facilitating urging of the terminal member through a vascular system by a magnetic urging means located externally of the subject.
- 30 79. A guide wire as claimed in Claim 78 characterised in that the terminal member is of a magnetic material.

80. A guide wire as claimed in any preceding claim characterised in that a distal portion of the guide wire is of a magnetic material for facilitating urging of the terminal member through a vascular system by a magnetic urging means located externally of the subject.

5

81. In combination the guide wire as claimed in any of Claims 78 to 80 and a magnetic urging means for urging the terminal member through a vascular occlusion.

10

82. In combination the guide wire as claimed in any of Claims 78 to 80 and a magnetic urging means for urging the terminal member through a vascular system to a vascular occlusion.

15

83. A method for re-canalising a vascular occlusion in a human or animal subject, the method comprising urging the terminal member of the guide wire of any of Claims 1 to 53 through the occlusion for gradually opening thereof.

20

84. A method as claimed in Claim 83 characterised in that the terminal member is urged by the guide wire through a vascular system to the occlusion prior to being urged through the occlusion.

25

85. A method as claimed in Claim 83 or 84 characterised in that the terminal member is urged through the occlusion by a magnetic urging means located externally of the subject.

86. A method as claimed in any of Claims 83 to 85 characterised in that the terminal member is urged through a vascular system by a magnetic urging means located externally of the subject.